P-102

Micro-relief and roughness of the surface of the profiled sulfocation-exchange membrane after its contact with phenylalanine solution

V.I. Vasil'eva, E.A. Goleva, M.A. Smagin, E.O. Abramova, D.V. Kostylev

Voronezh State University, 394018,Voronezh, Russia
e-mail: viv155@mail.ru

Using atomic force microscopy the surface of the profiled cation-exchange membrane MK-40pr was investigated before and after its contact with amino acid solutions. Micro-profiles and average statistical parameters of the surface roughness for the original conditioned membrane and the sample were determined after their contact with phenylalanine solution. The problem of this work is to find out the influence of alkylaromatic amino acid – phenylalanine – on the micro-relief and surface roughness of the profiled sulfocation-exchange membrane.

Heterogeneous sulfocation-exchange membrane MK-40pr with geometrically inhomogeneous (profiled) surface was employed as an object of investigations. Conditioned samples and membranes were studied after their contact with phenylalanine solution with the concentration of 0,15 M for 100 hours. Investigations of the surface micro-relief of the membrane were performed by atomic force microscopy (AFM) with the use of scanning probe microscope produced by NT-MDT Corporation (model Solver P47 Pro) (Zelenograd, Russia) performed in semi-contact mode applied to the air-dry samples. Results were estimated by the representation of relief in the form of topographic map as two-dimensional and three-dimensional digital images of the surface. Analysis of the obtained AFM images was performed with the use of software package AFM Solver P47 Pro Nova RC1 and it was concerned with the analysis of the amplitude average statistical parameters of the surface roughness in accordance with the international standards ISO 4287/1 and ANSI B. 46.1: R_y – is the height spread (maximum heights drop between the highest and lowest points of the surface profile) R_a – is the arithmetical mean roughness, R_q – is round mean square roughness, R_z – is the surface roughness over ten selected maximum heights and hollows.

AFM-images and microprofiles of the surface for the profiled membrane MK-40pr were obtained with a scanned area of 10×10 μm before and after the contact with phenylalanine solution. Image of the surface for the conditioned sample of sulfocation-exchange membrane MK-40pr appears as a developed chaotic structure with micrometer-scaled roughness: arithmetical mean roughness R_a fits with 186,4 nm at R_z=953,1 nm.

The effect of phenylalanine on the properties of the surface for the original sulfocation-exchange membrane MK-40pr is in the decrease of all the amplitude roughness parameters. Surface of the membrane after itscontact with phenylalanine became more uniform:surface roughness R_z fitted with 745,0 nm, while ariythmetical mean scale of roughness R_a – 172,8 nm.

Histograms comparing the heights density distributions on the surface of conditioned sample of MK-40pr membrane before and after its contact with phenylalanine solution are studied. As for the conditioned sample of MK-40pr membrane the maximum density corresponds to the mean value of the surface roughness equal to 1 μm, while for the sample of membrane after its contact with phenylalanine histogram is characterized by a spread maximum and a decrease of the mean roughness value up to 0,6 – 0,8 μm, as well.

Thus, the difefrences in the properties of the surface for the samples of profiles heterogeneous sulfocation-exchange membrane before and after its contact with phenylalanine solution have been visualized. An increase of uniformity for the membrane surface was found after its contact with the amino acid.

The work was conducted under financial support of RFBR (project N 18-08-01260).